

US EPA ARCHIVE DOCUMENT

Making Decisions Based on Single Samples

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Committee:

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Issue: Transition a Biocriteria Assessment Method to a Regulatory Decision-making Tool

- ❖ Needed to develop method for next 303(d) List.
- ❖ Needed to start with existing biocriteria methodology.
- ❖ Needed to get “buy-in” from many different stakeholders.
- ❖ Confidence in decision a critical criterion.

Process

- ❖ Assemble an advisory committee with all sectors represented.
- ❖ Chair from an academic institution.
- ❖ Examine the existing methodology and simultaneously educate the Committee members.
- ❖ Lay out key issues for resolution.

Key Issues

- ❖ Confidence in the method?
- ❖ How many samples to make a decision?
- ❖ Spatial scale?
- ❖ When a probabilistic sample in a stream segment indicates a possible impairment, but resources are not available to assure a return sampling, how do you address that site with respect to 303(d)?

Issue Resolution

- ❖ Confidence in the method?
- ❖ How many samples to make a decision?
- ❖ Spatial scale?
 - Parts of the same question.
 - Decided on a confidence interval approach that incorporated number of samples but allowed for decisions in segments with single samples.
 - Default confidence limit in where $n < 10$.
 - Site-specific confidence limit where $n > 10$.

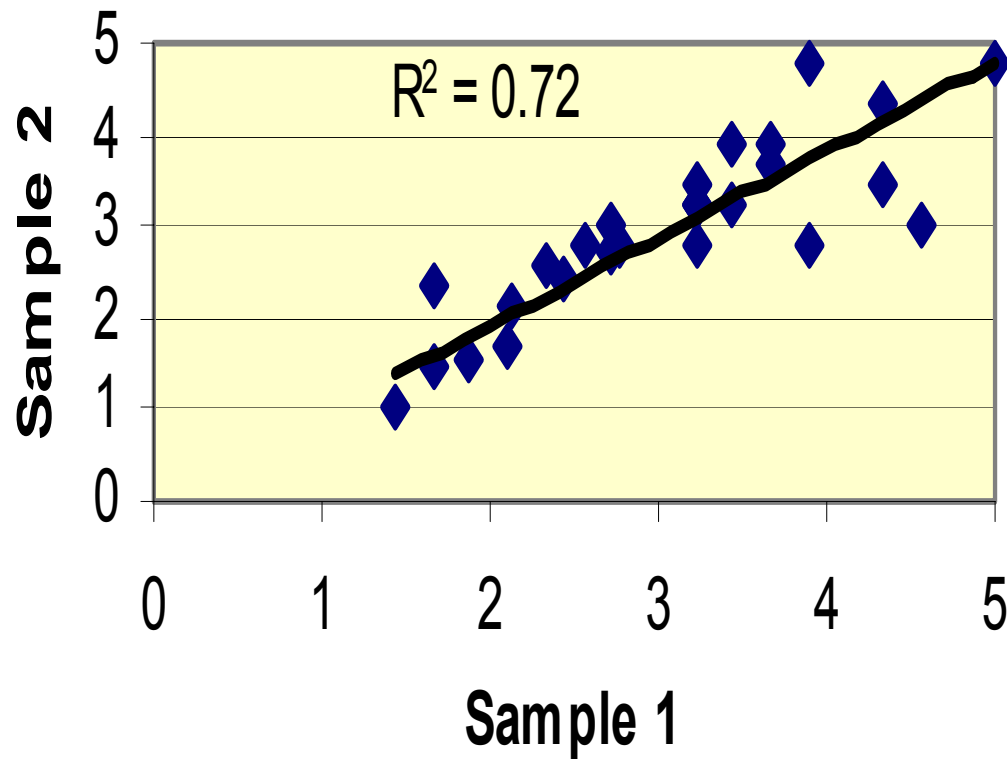
Issue

- ❖ In the interim framework it was recognized that the application of a default .75 standard deviation was a temporary solution that had several problems:
 - Considering that the IBI scale is only 4 units, this indicates considerable uncertainty.

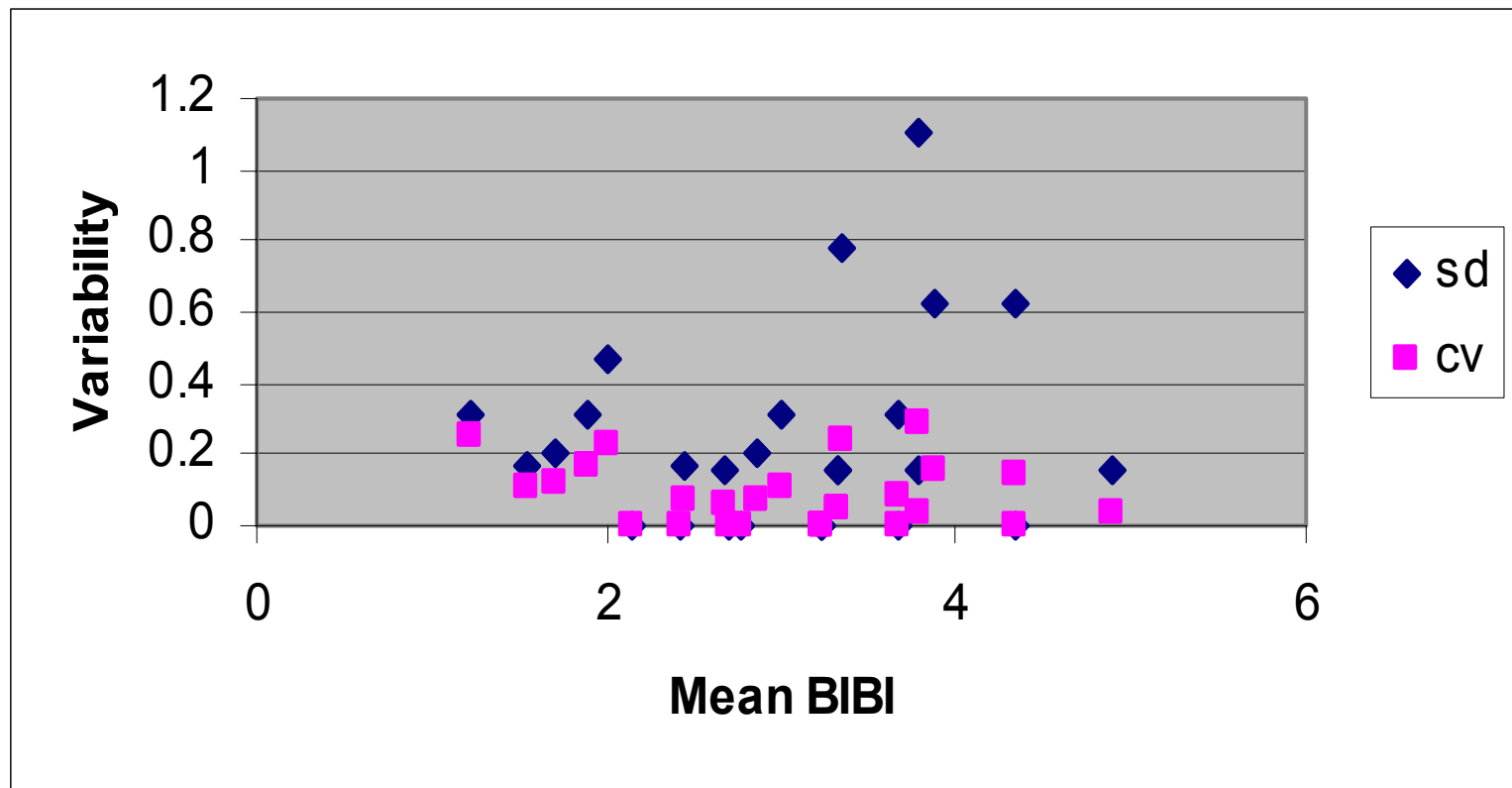
Issue (continued)

- It was possible that with re-analysis the size of that confidence interval could be reduced.
- The one-sided aspect for impairment only was not consistent.
- It was not consistent with the 8-digit watershed approach.
- Better methods were possible.

MBSS 1995-1997
BIBI for duplicate samples



MBSS 1995-1997 replicates within stream segments – variability versus mean BIBI score



Use model to estimate precision for single scores

- ❖ Estimate mean *s* and *cv* based on MBSS 1995-1997 duplicate samples (n=27)
- ❖ Plug value into formula for *SE* or *RSE*
- ❖ *n = 1 for single scores*

BIBI for replicate sampling within stream segments, MBSS 1995-1997

n

		Stream order			
Metric	Statistic	1	2	3	All
	n	10	8	9	27
BIBI	\bar{x}	2.60	3.39	3.13	3.01
	\bar{s}	0.12	0.25	0.35	0.24
	$c\bar{v}$	0.06	0.08	0.11	0.08

Estimation of standard errors

$$SE = \frac{\bar{s}}{\sqrt{n}}$$

or

$$SE = IBI \times \frac{c\bar{v}}{\sqrt{n}}$$

How do we use this information?

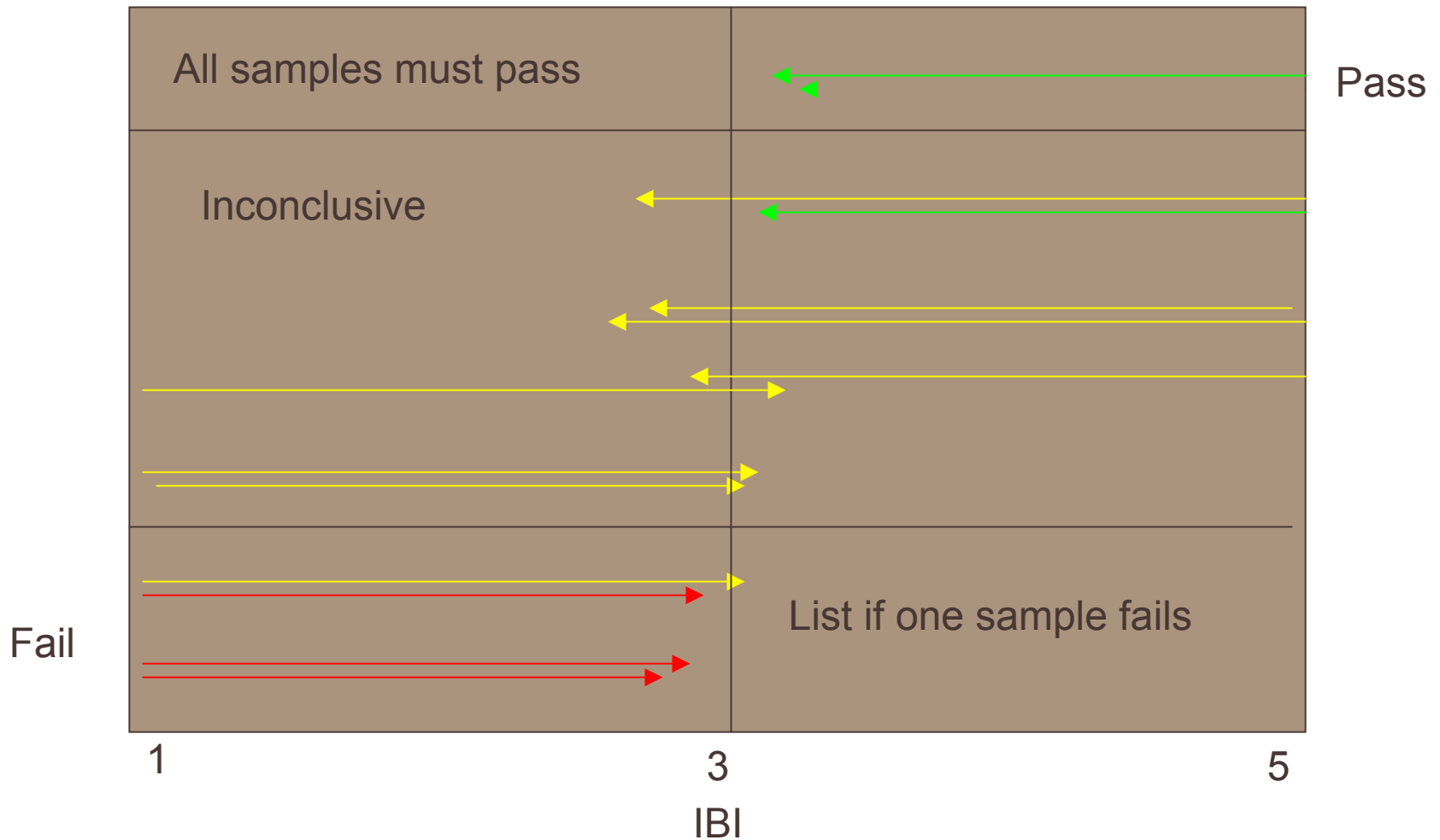
- ❖ Construct confidence intervals for IBI scores

$$\hat{X}_L = \bar{x} - t \times SE, \quad \hat{X}_U = \bar{x} + t \times SE$$

Some options for calculating confidence limits

- ❖ 90% or 95% confidence limits
- ❖ One-sided or two sided
- ❖ Use mean standard deviation or *cv*
- ❖ By stream order, or overall

*Listing framework, using one-sided 90% confidence intervals
and cv of 8% for BIBI and FIBI.*



Outcome

- ❖ Approximately 175 new 303(D) listings based on biological assessments.
- ❖ The majority are sub-watersheds within larger watersheds already impaired for nutrients or sediments.
- ❖ TMDL development low-priority under assumption that correcting sediment impairments will significantly improve stream quality.